John F. Kennedy Space Center's Improved Optical Fallout Monitor

The National Aeronautics and Space Administration (NASA) seeks to transfer the NASA-developed Optical Fallout Monitor (OFM) technology for commercial use in contamination monitoring or activity monitoring. The system, developed at the John F. Kennedy Space Center (KSC), is being used as a real-time contamination monitoring system to detect the accumulation of potentially damaging dust and fibers on sensitive payload components. In addition to its use as a fallout detector, the system has demonstrated effectiveness in monitoring activity versus inactivity based on recorded increases in fallout levels resulting from motion within a monitored area. The potential sensitivity of commercial systems may lend the technology to security monitoring. NASA seeks a company that is interested in developing or modifying this technology for commercial application.

BENEFITS

- Performs real-time measurement calibration in the field
- Records particle accumulation in real time (this enables correlation to outside events)
- Operates on internal battery source independent of facility power supply
- Stores up to 32k bytes of data in existing design
- Uses commercially available components
- Enables users to set sampling intervals
- Is inexpensive when compared to equipment of comparable levels of sensitivity

technology opportunity

APPLICATIONS

- Contamination monitoring
  - Clean rooms
  - Industrial applications like pharmaceutical or semi-conductor manufacturing
- Activity monitoring
  - Medical patient monitoring
  - Accumulated animal motion
  - Security
- Air-handling assessment
  - Performance assessment
  - Verification

TECHNOLOGY STATUS

- ☐ Patent pending
- ☑ U.S. Patent No. 5,412,221
- ☐ Copyrighted
- ☑ Available to license
- ☐ Available for no-cost transfer
- ☐ Seeking industry partner for further codevelopment

Technology Details

The Optical Fallout Monitor (OFM) was originally developed by NASA engineers to replace a manual method for monitoring and measuring the accumulation of dust and other damaging particles on delicate payload components. The OFM can monitor and record the fallout activity in areas in which sensitive payloads are stored. Prior to this, NASA used witness plates and manual microscopic examination to identify particles and amounts. The OFM, which is battery-operated and has memory capability, was designed using commercially available components.

Modifications have since been made to upgrade the system. Initially the monitor's sensitivity was inadequate for use in very clean environments. This was corrected by replacing a 12-bit analog-to-digital converter (ADC) with a new 20-bit ADC. The integrated-circuit chip, of which the 20-bit ADC is a part, affords additional digital filtering capabilities that are exploited to increase effectiveness under adverse lighting situations. To accommodate the circuitry, a circuit board was completely redesigned, with special attention to quality of signal and reliability. The new circuit board supports additional features, including programming of operating parameters via a keypad, a current-loop or voltage analog output, and new power-utilization features.

The system now operates on modified software that provides, among other things, the ability to reprogram "on the fly" (without disrupting operation) to adjust such parameters as sensitivity ranges and data-taking intervals. Prior to this improvement, it was necessary to restart the system to put it in a programming mode. The modified software enables remote reprogramming or downloading of data by serial data communication via a cable. Another deficiency involved the OFM's lack of sufficient thermal stability for use in nontemperature-controlled environments. A reference photodetector with an independent ADC was added. These components make it possible to measure and correct fluctuations in the output of the LED, thereby considerably increasing the temperature stability of the system.

The mirror in the original monitor was replaced with a witness plate in the form of a silicon wafer bonded to an aluminum substrate. Holes in the substrate make it possible to scan the silicon wafer by use of a semiconductor-wafer scanner. In addition, optics have been simplified to reduce the number of surfaces through which light must pass, increasing throughput of the light. Finally, the electrostatic-charge issue was addressed by repackaging the system in an aluminum enclosure, which can be grounded.

Partnership Opportunities

NASA has acquired patent to the Improved Optical Fallout Monitor and is seeking licensees of the patent. NASA has the authority to grant licenses on its domestic and foreign patents and patent applications pursuant to 35 U.S.C. 207-209. NASA has implemented this authority by means of the NASA Patent Licensing Regulations, 37 CFR § 404. All NASA licenses are individually negotiated with the prospective licensee, and each license contains terms concerning commercialization (practical application), license duration, royalties, and periodic reporting. NASA patent licenses may be exclusive, partially exclusive, or nonexclusive. If your company is interested in the new Improved Optical Fallout Monitor technology, or if you desire additional information, please reference Case Number KSC-11687 and contact:

Jeff Kohler
Innovative Partnerships Program
Mail Code: KT-A2
Kennedy Space Center, FL 32899
Telephone: (321) 861-7158
Fax: (321) 867-2050
jeffrey.a.kohler@nasa.gov